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Technology and Costs

TECH 2021S10: Advances in Depolymerization Technologies for Recycling

Advances in Depolymerization Technologies for Recycling is one in a series of reports published as part of NexantECA's 2021 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

The reduction and reuse of post-consumer plastic waste is currently one of the key issues facing the plastics industry. Approximately 10 percent of the plastics produced worldwide are recycled, with the remaining ending up in landfills or incinerated.

For many years, plastics have been recycled using conventional (i.e., mechanical) methods. However, as the applications have become more demanding, conventional recycling is no longer enough, particularly because of the inconsistent quality of the mechanically recycled plastic. Advanced technologies such as depolymerization have attracted increased interest, as the recycled monomers can be used to manufacture plastics of the same quality as those produced from virgin materials.

This TECH report provides an updated overview of the technological, economic, and the state of the market of plastics that can be produced from waste depolymerization. The following issues are addressed in this report:

- What are the main routes to produce plastics from depolymerized waste? Who are the major technology developers?
- What is the status of the different depolymerization technologies?
- How do the economics of producing plastics from recycled and virgin monomers compare across different geographic regions?
- What are the opportunities and challenges of depolymerization technologies for the various plastics studied in the report?

Depolymerization Technologies

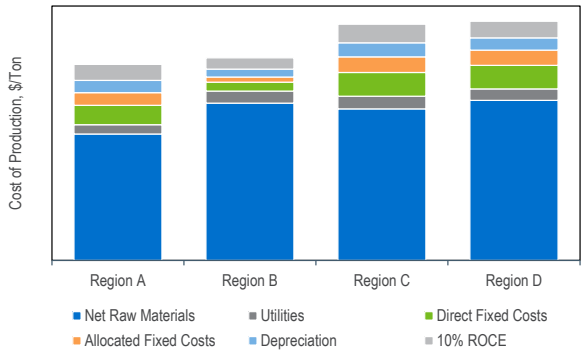
Depolymerization breaks down the plastic waste into oligomers or monomers using techniques such as glycolysis, hydrolysis, methanolysis, or thermal pyrolysis, among others. The obtained monomers can be purified and repolymerized into a product with the same (or higher) value as the one that generated the waste.

This report examines the main commercial and developing processes for depolymerization of polyamide, polycarbonate, polyethylene terephthalate, polystyrene, polyurethane, and polymethyl methacrylate. Profiles of the main technology developers are also included.

Process Economics

Detailed cost estimates are presented to produce recycled monomers and corresponding plastics from waste material, at USGC, Western Europe, China, and Japan locations. Estimates are developed for all the six polymers covered in the study. Sensitivity analyses on feed pricing are also included.

Recycled Styrene Monomer Production Costs



State of the Market

Depolymerization technology is not new, but stricter legislation and a growing demand for recycled content has driven a new wave of investment and research. Several projects to establish chemical recycling as a commercially viable proposition are being driven by the raw material producers themselves, often in collaboration with government institutions, universities, and partners along the value chain.

Despite the potential to be a complementary solution to mechanical recycling, depolymerization technologies still face several challenges. These are reviewed in this report, along with the commercial status of the several projects under development.

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TECH's comprehensive studies include detailed technology analyses, process economics, as well as commercial overviews and industry trends. Reports typically cover:

- Trends in chemical technology
- Strategic/business overviews
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- Chemistry
- Process flow diagrams and descriptions of established/conventional, new and emerging processes
- Process economics – comparative costs of production estimates for different technologies across various geographic regions
- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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